

LEANING TOWER of PISA INFORMATION

TOWER BASICS

Official Name: TORRE PENDENTE DI PISA

Function: Bell Tower (Campanile)

Original Architect: Bonanno Pisano

Years Built: 1173-1350

Base Elevation above Sea Level: About 2 meters

First Construction Stop: 1178 (War with Firenze)

Year in which lean became obvious: 1178 (Third Story)

Height at which lean became obvious: 10.6 meters (35 ft.)

Second Construction Stop: 1185 (War with Firenze)

Later Construction Stop: 1284 (War with Genoa, Major Sea Battle Defeat)

First Bells added: 1198 (Third Floor)

Height: 55.863 meters (185 feet). 8 stories.

Outer Diameter of Base: 15.484 meters

Inner Diameter of Base: 7.368 meters

Direction of Lean: 1173-1250 North, 1272-1997 South

Architect who realized that the Leaning Tower could not be straightened : Tomasso di Andrea da Pontedera (1275)

Level at which Tower Straightens to North: 5

7th Floor Completed: 1319

Bell Tower Completed: 1350

Number of Bells: 7, tuned to musical scale

Largest Bell: Three and a half tons, cast in 1655.

Oldest Bell's name: Pasquarreccia

Address: Campo dei Miracoli - the "Field of Miracles", Pisa, Italia

Weight: 14,700 metric tons

Thickness of Walls at the Base: 8 feet

Year cement injected into base, (blamed for lean acceleration): 1934

Lean Data Provided by Prof. Pierotti:

1.43 meters (1298) (Giovanni Pisano, reconstructed by P. Sanpaolesi)

3.79 meters (around 1550) (Vasari, six arms and half)

3.79 meters (1787 and 1812) (By Morrona, six arms and half)

3.84 meters (1817) (Crazy & Taylor, 12 feet and 7 thumbs)

4.04 meters (1911) (Pizzetti) (+ 20 cm Crazy & Taylor)

The 1911 measure was taken from the outside of the seventh cornice with a theodolite (not from the inside with a plumb line) and therefore the resulting linear values are greater due to the thickness of the cornice, leaning relative to the body of the tower.

Other Sources:

Lean: 1.63 meters (1360)

Lean: 1.43 meters (1372) The Guardian (London) August 19 1997

Lean: 3.77 meters (1550)

Lean: 4.75 meters (1817)

Lean: 4.8 meters (1935)

Lean: 5.2 meters (1997)

Steps to Bell Tower: 294 Number of visitors who climbed to top in 1989: 700,000 Date Closed to Public: 7 January 1990 Rate of Fall in 1990: 1.2 mm (1/20") every year ("Un millimetre per anno") Source: The Guardian (London) August 19 1997 Weight of Lead added on North side (picture above): 600 tons (1995) Amount of tilt recorded overnight in September 1995: 2.5 mm (0.07") Weight of Lead added after overnight tilt: 230 tons Amount of tilt correction since 1990: 25mm (1.0")

Italian Federal Legislation for Restoration of the Leaning Tower

Leaning Tower Description posted by Hotel DiStefano, Pisa

Leaning Tower of Pisa Architecture by David Speiser

Work by Vittorio Novelli:

A Definitive Proposal to Save the Tower of Pisa

Structural Analysis and Calculations related to the Tower of Pisa

Phases of Construction

News Article about Vittorio Novelli

Trouble at the Leaning Tower

Construction Details by Prof. Piero Pierotti:

History

Date of Construction

The Measurements

The Construction

The Stairs

The Bell Tower

Pioretta Leaning Tower Website

ArtWatch International:

ArtWatch Comment

Tower Troubles

Experts Wrangle Over Best Angle

PARTICIPANTS and CONTRIBUTORS
to the TOWER STABILIZATION

List compiled from various sources

Bonanno Pisano	Architect of Tower (attributed)
Galileo Galilei	Experimenter at the Tower ?
Vittorio Novelli	Surveyor from Cesena (Forli)

Commissions and Committees

- 1298 Commission - Giovanni Pisano, Guido Di Giovanni, Orsello
- 1840 Commission - Castinelli, Lapi, Martolini
- 1907 Commission - Bernieri, Canavari, Cuppari, Fedeli, Galli, Pizzetti, Socini
- 1912 Commission - Bacci, Bernieri, Canavari, Ceradini, Cuppari, Giudi, Ongaro, Susinno, Toscanelli
- 1924 Commission - Bernieri, Canavari, Canevari, Fascetti Giulio, Fascetti Giuseppe, Giovannoni, Susinno
- 1925 Pisan Committee - Allegretti, Bacci, Bernieri, Bertuzzi, Canavari, Cerpi, Fascetti Giulio, Fascetti Giuseppe, Ferrucci, Lecci, Manghi, Puntoni, Simoni, Ugolini
- 1926 Pisan Committee - Bernieri, Buffarini Guidi, Fascetti Giulio, Fascetti Giuseppe, Lecci, Manghi, Niccolai, Puntoni, Simoni, Ugolini
- 1926 Pisan Committee - Bernieri, Canavari, Cassinis, Cicconetti, De Marchi, Fascetti Giulio, Niccolai, Petri, Sesini, Ugolini
- 1927 Pisan Committee - Battaglia, Canavari, Cassinis, Ciappi, Cicconetti, Crema, De Marchi, Fantoli, Fascetti Giulio, Giovannoni, Guidi, Pellati, Poggi, Sesini, Susinno, Ugolini
- 1932 Commission - The proceedings are remembered but the names of the members were not documented. It was a "special commission" entrusted to attend to the works of 1934-35.
- 1949 Commission - Albenga, Arcuri, Ballantini, Ballrin, Boaga, Donato, Fascetti Giulio, Fortini, Franco Fausto, Girometti, Leschiutta, Marcantoni, Marchesi, Mario, Moncelli, Natoni, Noccioli, Pepe, Pistolesi, Ramalli, Rendola Rosi, Sanpaolesi Piero, Spina, Trevisan
- 1964 Commission - Bendini, Beneo, Camanni, Ceschi, Cestelli Guidi, Croce, Franco Antonio, Giusti, Locatelli, Lumini, Marcheti, Molajoli, Noccioli, Pistolesi, Polvani, Prete, Roselli, Sanzo, Savarese, Schultze, Skempton, Trevisan, Vozzi
- 1965 Commission - Bendini, Beneo, Bonatti, Calabresi, Camanni, Canepa, Carrara, Caselli, Ceschi, Cestelli Guidi, Croce, D'Alessandro, Da Porto, De Sanctis, Franco Antonio, Gangemi, Giusti, Locatelli, Lumini, Maccagni, Marchetti, Marussi, Molajoli, Noccioli, Ortolani, Pistolesi, Polvani, Prete, Ricci, Roselli, Rosini, Salvioni, Sanzo, Savarese, Schultze, Selleri, Skempton, Tornar, Trevisan,

Viggiani, Vozzi

1965 COMMISSION President prof. GIOVANNI POLVANI

At the end of its order the 1965 commission set itself to the form of the completed task. The proclamation undertook 22 articles, in principal they were:

1. Application of actions to the tower that produce a reverse to its movement.
2. Modification of the existing foundation with insertion of piling under the old and new structures.
3. Stabilization of the earth based on favorable deformations caused by appropriate measures.
4. Amelioration of the pertinent mechanical properties of the meaningful volume of the ground underlying the tower.
5. Reduction of the inclination not more than one degree equal to 1.019 Meters of lean.

1972 Commission - Agresti, Berti, Bertolini, Capriotti, Cestelli Guidi, Conte, Croce, D'Ambrosio, De Sanctis, Evangelista, Faltelli, Guasco, Kezdi, Locatelli, Lumini, Noccioli, Occhiuzzi, Prete, Rossi Adriano, Rossi Eugenio, Schultze, Secchi, Selleri, Silvestro, Spanò, Toniolo, Tornar, Travaglini, Trevisan, Zuppari

1983 Commission - Bartelletti, Berardi, Caroti, Finzi, Jamiolkowski, Raghianti, Sanpaolesi Luca

1988 Technical Committee - Calzona, Daniele, Del Monte, Gabbani, Giangreco, Gurrieri, Jappelli, Pozzati, Scarselli, Selleri

1990 Committee for the introductory operations (intended for appointment): Burland, D'Elia, Desideri, Di Stefano, Jamiolkowski, Gurrieri, Lemaire, Leonards, Leonhardt, Veniale, Viggiani